FTD-TT- 63-12

6332

TRANSLATION

MEASURING THE PARAMETERS OF ANTENNA-FEEDER DEVICES (SELECTED PARTS)

By

A. Z. Fradin and Ye. V. Ryzhkov

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

WRIGHT-PATTERSON AIR FORCE BASE

OHIO

402465

UNEDITED ROUGH DRAFT TRANSLATION

MEASURING THE PARAMETERS OF ANTENNA-FEEDER DEVICES (SELECTED PARTS)

BY: A. Z. Fradin and Ye. V. Ryzhkov

English Pages: 13

SOURCE: Russian Book, Izmereniye Parametrov Antenno-Fidernykh Ustroystv, Moskva, 1962, pp 266-272, 314-316

Table of Contents

FIRST LINE OF TEXT

Plotting the Diagram of the Directivity of Antennas with the Aid of Airplanes and Helicopters

General Information

The plotting of diagrams of the directivity of stationary antennas with ranges of short and ultrashort waves, as was shown above, is done mainly from airplanes and helicopters.[1] This makes it possible to take measurements in any plane, obtain data for the making of cartographic diagrams of the directivity, and besides it makes it possible to record automatically the directivity diagram, which excludes individual errors of observation and assures complete objectivity and documentation of the results. The first automatic recording of a diagram of directivity with the aid of an airplane was done in 1934 by V. V. Tatarinov [12].

The equipment for plotting diagrams of directivity from airplanes should consist of a transmitting device, an auxiliary antenna, and instruments for tracking a flying apparatus.

There are two variants possible in the arrangement of the apparatus--directly on the aircraft or on a craft in tow.

[1] The plotting of a directivity diagram is best done from a helicopter, since in the first place from an airplane it is difficult to correlate the notation of the indices of the instruments with its position, and in the second place the measurements from an aircraft have to be done over great distances, and for antennas with raised main lobe, besides at great altitude, which requires a complicated system of radar observation.

Transmitting Device

For plotting the directivity of antennas of active transmitting radio centers it is expedient to use the investigated antenna as a transmitting antenna, and as a generator, an operating transmitter in the role of carrier.

For investigating antennas of receiving radio centers or transmitting radio centers under construction it is necessary to have special measuring generators which one can place both on the flying craft and the craft in tow. In the first case as a measuring generator one can use the GSS, but generally the GSS use current of a frequency of 50 cps, and the airborne circuit has a higher frequency. Therefore one has to use a frequency converter or storage batters and change DC into AC.

Generators set up on towed craft should have little weight and be compact and hermetically sealed. It is convenient to supply them with electricity from batteries. The power of the generators is not great--from a fraction of a watt to a watt. They should be designed for a series of fixed frequencies. The setting up for the required frequency is done before the flight. In special generators, airborne and on towed craft there should be quartz stabilization of the frequency.

It is expedient to use the investigated antenna as a receiving one.

Receiving Device

For plotting the diagram of directivity of antennas of active transmitting radio centers as a receiving apparatus one can use commercial receivers, devices for measuring the intensity of the field, disturbance meters, etc. Automatic volume control should be connected in and the receivers calibrated.

The arrangement of the receiver on the flying craft requires that one assure its stability against disturbance and that it be well buffered,

and this applies also to the recording devices.

The problem of assuring stability against disturbance is made easier through the use of the operating transmitter of the radio center, which as a rule has great power and can create considerable fields at the place of the reception. One can improve the stability against disturbance by shielding off the receiver well blocking it on the power supply circuits.

In using the investigated antenna as a receiving one it is most expedient to use commercial receivers which have high sensitivity, since on a flying craft it is necessary, as was pointed out above, to install low-power generators.

Auxiliary Antennas

On airplanes andhelicopters which are devoted specially to atenna measurements the auxiliary antennas can be installed in the best way.

At the present time in using ordinary cruising flying craft one may propose the following varations in the arrangement of the auxiliary antennas.

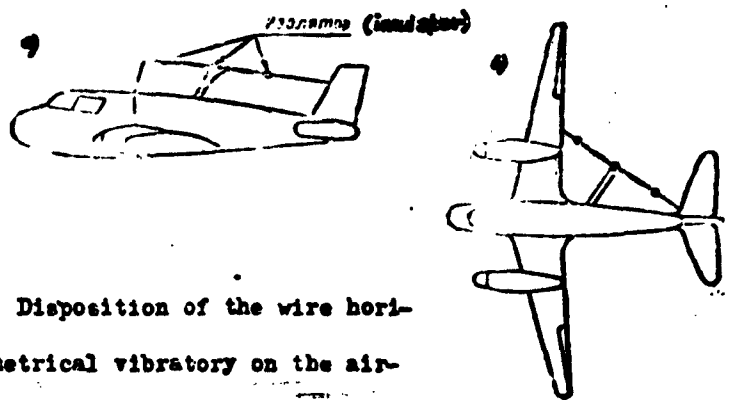

Fig. 9.10. Disposition of the wire horizontal symmetrical vibratory on the aircraft: a) above its fuselage; b) between the wing and the tail part.

In the case of horizontal polarization of the field of radiation, as auxiliary antennas one uses symmetrical vibrators. In Fig. 9.10 there are shown two variations of the arrangement of a short-wave vibrator made of thin copper wire or antenna stranded wire--above the fuselage of the airplane

and between the wing and the tail part. The arrangement of an analogous antenna on a helicopter is shown in Fig. 9.11. Along with the wire antennas one uses also antennas of copper tubes fastened to a wooden rod (Fig. 9.12).

Fig. 9.11. Arrangement of wire symmetrical horizontal vibrator on a helicopter

Fig. 9.12. Arrangement of antennas of copper tube on an airplane above the fuselage.

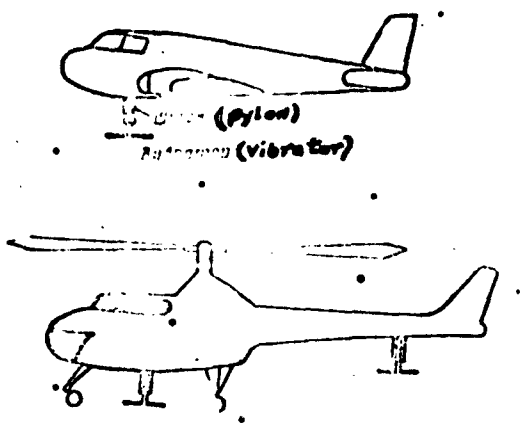

Fig. 9.13. Arrangement of antennas of copper tubes: a) under airplane; b) under helicopter.

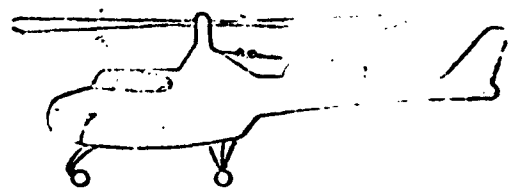

Fig. 11

On this same drawing there is shown the arrangement of the antenna intended for vertical polarization.

For arranging the antenna under the fuselage of a flying craft (9.13) it is necessary to set up auxiliary construction: pylons, mechanisms for removing the antenna, etc. In practice this question is solved in the following fashion. The vibrator is mounted on telephone supports fastened to a wooden beam. The beam is fastened ordinarily with rubber packing materials reaching around the fuselage of the craft (Fig. 9.14). The vibrators preferably are arranged in such a way that their axis coincides with the direction of motion of the flying craft.

Along with the antenna of vertical polarization (Fig. 9.12), one also

uses a flexible stick (Kulikov's antenna).

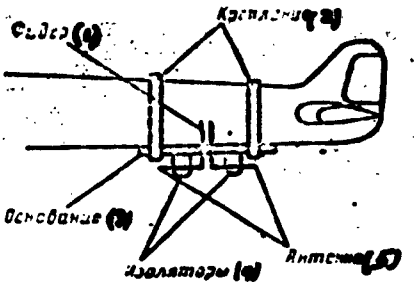

Fig. 914. Fastening of the symmetrical vibrator to the tail part of a helicopter

Key: (1) feeder; (2) fastening; (3) base; (4) insulators; (5) antenna.

The arrangement of the antenna in the case of locating the measuring apparatus on the towed craft is shown in Fig. 9.15. In this case the antenna finds itself at a considerable distance from the flying craft, and its diagram of directivity is not distorted by it, as in the case of the methods of placing described above. In the case of towed craft one end is fastened to a conical parachute of nylon and the other by a caprone rope to the flying craft.

The dimensions of the vibrator are selected in accordance with the length of the wave on which the testing is done from the computation $2l \approx \frac{\lambda}{2}$, where l is the length of the arm of the vibrator. If $2l \ll \frac{\lambda}{2}$ then for the increase in the operating height of the vibrator onto its ends there are placed hollow metallic spheres.

In the case of a towed antenna of vertical polarization (Fig. 9.15) there should be suspended on the lower end a weight for giving it a vertical position.

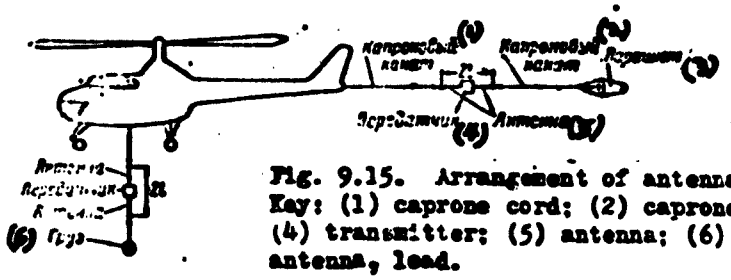

Fig. 9.15. Arrangement of antenna towed by helicopter
Key: (1) caprone cord; (2) caprone cord; (3) parachute; (4) transmitter; (5) antenna; (6) antenna, transmitter, antenna, lead.

Instruments for Tracking the Flying Craft

The system of tracking the flying craft and the correlation of the indications of the instruments which record the intensity of the field with the coordinates of the flying craft present a complicated problem which has not yet received a final solution. Let us consider some of them which are being used in practice.

As instruments which note the coordinate of the flying craft one uses a theodolite set up near the antenna being investigated and serving for determining the azimuthal angle and the angle of the place, and an altimeter of the flying apparatus for determining the altitude of the flight. It is convenient to use these instruments when the antenna being investigated is a receiving antenna. The instrument which shows the intensity at the output of the receiver can be located close to the theodolite, so that there is possible simultaneous recording of the angles of the setting of the theodolite and the intensity on the output of the receiver. The airplane or helicopter should fly in a circle with the center in the intermediate point of the antenna and at a constant height controlled by the altimeter. Besides, it should remain all the time in the field of vision of the theodolite.

In making measurements from an airplane flying at great speed, and with sharp directivity of the investigated antenna the observations should be made by three operators. One follows the airplane through the telescope of the theodolite holding it constantly on the cross hairs of the or the objective, the second observes the angular scales of the theodolite, and the third is behind the instrument which shows the intensity at the altitude of the receiver or behind the airplane. On a signal from the operator recording the angle the third records the intensity on the instrument or makes marks on the type of the self-recorder.

With a comparatively broad lobe of the directivity pattern of the antenna and not very great speed of flight, two or even one operator can make the observation. In the case of helicopter measurements the recording of the angles and the intensity at moments of brief hovering of the helicopter. the observation can be done by one operator.

If one replaces the theodolite by an automatic radar station with great resolving capacity and synchronizes its working with the work of the automatic recorder, then the plotting of the pattern of directivity can be done automatically.

If the antenna being investigated works on radiation and the receiving apparatus is located on the flying craft, as an instrument for tracking one can also use the theodolite. But since the operator who records the intensity at the output of the receiver finds himself in this case on the flying craft, the connection between the ground and the flying craft should be very good. The measurements are made in the following fashion.

On the route of the flight one notes ground orienting point the angular coordinates of which are known in flying over these orienting points the operator records at the altitude of the receiver. If one uses an automatic recorder then two orienting points are sufficient--the initial one at which the automatic recorder cuts in, and the final one at which it cuts out. The speed of the flight of the airplane during the period of the recording should meanwhile be strictly constant.

In researching transmitting antennas it is also possible to use radar stations which track the flight of the aircraft, in accordance with the signals of which one records the intensity and cuts in or cuts out the automatic recorder. Instead of an automatic recorder one can use a loop oscillograph.

In order for the measurements with the aid of a flying craft to be suc-

cessful they must be carefully prepared, and in this preparation there should be preliminary checking measurements.

Table of Contents

DISTRIBUTION LIST

DEPARTMENT OF DEFENSE	Nr. Copies
HEADQUARTERS USAF	
AFCIN-3D2	1
ARL (ARB)	1
OTHER AGENCIES	
CIA	1
NSA	6
DIA	9
AID	2
OTS	2
AEC	2
PWS	1
NASA	1
ARMY	3
NAVY	3
NAFEC	1
RAND	1

MAJOR AIR COMMANDS	Nr. Copies
AFSC	
SCFDD	1
ASTIA	25
TDBTL	5
TDBDP	9
SSD (SSF)	2
APGC (PGF)	1
ESD (ESY)	1
RADC (RAY)	1
AFSWC (SWF)	1
AFSTC (MTW)	1
ASD (ASYIM)	1